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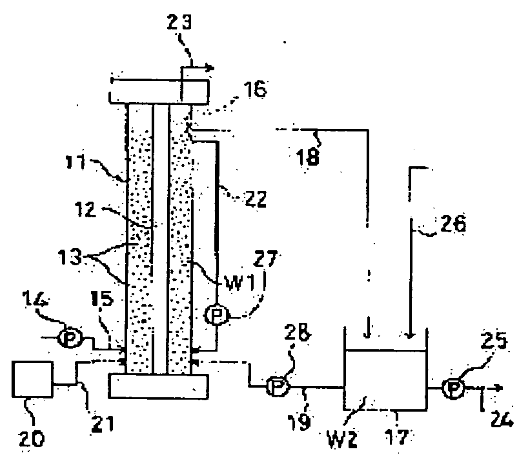
(54) METHOD AND APPARATUS FOR TREATMENT OF WASTEWATER

(57)Abstract:
PROBLEM TO BE SOLVED: To remove by degradation efficiently trace poisonous materials such as PCDDs or the like by a method wherein water is passed through an ultraviolet ray reaction tower holding a photocatalyst accelerating oxidation reaction of wastewater, and the trace poisonous elements in the wastewater are removed by degradation with the photocatalyst and ultraviolet rays.
SOLUTION: In an ultraviolet and ozone reactor, sand filtration treated water W1 of wastewater containing poisonous materials flows into a reaction tower 11, flows upwards together with a photocatalyst 13, an ultraviolet ray is radiated from an ultraviolet lamp 12, and ozone is supplied from an ozone generator 20. The sand filtration treated water W1 near an outlet permeates a net 16, is conducted as ultraviolet and ozone treated water W2 out to a pHa adjusting tank 17, and the photocatalyst 13 remaining with the net 16 is circulated together with the surrounding treated water W1 near to a flow inlet. During this time, it comes in sufficient contact with the powder photocatalyst 13 in the reaction tower 11, and trace poisonous substances such as PCDDs or the like in the sand filtration treated water W1 are efficiently removed by degradation with synergism of the ultraviolet ray and the photocaralyst 13.



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CLAIMS

[Claim(s)]

[Claim 1] The sewage disposal approach characterized by letting water flow to the ultraviolet-rays reactor which is the sewage disposal approach of processing the sanitary sewage containing minute amount harmful matter, such as dioxin, and held the photocatalyst which promotes oxidation reaction for said sanitary sewage, and carrying out decomposition removal of the minute amount harmful matter in the sanitary sewage by the photocatalyst and ultraviolet rays.

[Claim 2] The sewage disposal approach according to claim 1 characterized by introducing ozone inside an ultraviolet-rays reactor and carrying out decomposition removal of the minute amount harmful matter in the sanitary sewage by the photocatalyst, ultraviolet rays, and ozone.

[Claim 3] The sewage disposal approach given in either claim 1 which photocatalysts are fine particles and is characterized by circulating the sanitary sewage containing the photocatalyst near the outflow section near the inflow section, or claim 2.

[Claim 4] The sewage treatment unit characterized by holding the photocatalyst which forms an ultraviolet ray lamp in the interior of the reactor of the sealing structure which is the sewage treatment unit which processes the sanitary sewage containing minute amount harmful matter, such as dioxin, formed input in the end, and formed the tap hole in the other end along a flow direction, and promotes oxidation reaction.

[Claim 5] The sewage treatment unit according to claim 4 characterized by establishing an ozone supply means to supply ozone to the interior of a reactor.

[Claim 6] A sewage treatment unit given in either claim 4 characterized by establishing a circulation means by which photocatalysts are fine particles and circulate through the sanitary sewage which contained the photocatalyst near the tap hole in the reactor near the inflow section, and a photocatalyst separation means to separate a photocatalyst by the near side of a tap hole, or claim 5.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the sewage disposal approach and processor which process sanitary sewage containing minute amount harmful matter, such as dioxin, such as a leachate of a trash final disposal site.
[0002]
[Description of the Prior Art] For example, in case the leachate of the trash final disposal site which reclaimed land from domestic wastes or industrial waste is processed, extraction underwater impurity, sand, etc. were removed, coagulation sedimentation of the heavy metal, such as calcium and manganese, was carried out, decomposition removal of the BOD matter or the nitrogen content was carried out by biological treatment, coagulation sedimentation of the difficulty resolvability COD matter, the suspended solid, etc. was carried out, and sand filtration has removed the still more detailed suspended solid.
[0003] And by letting flow the sand filtration treated water 1 which does not contain a suspended solid to the reactor 3 which installed the ultraviolet ray lamp 2, and making the ultraviolet rays irradiated from an ultraviolet ray lamp 2, and the ozone supplied from an ozonator 4 contact, as shown in drawing 2 Decomposition removal of the minute amount harmful matter, such as dioxin which remains in sand filtration treated water 1, is carried out, and the pH regulators 6, such as a sulfuric acid and caustic alkali of sodium, neutralize the ultraviolet rays and the ozone treated water 5 which flows out from a reactor 3, and it is considering as treated water 7.
[0004]
[Problem(s) to be Solved by the Invention] By the way, since it is comparatively long, in order to have secured reaction time and to usually raise decomposition effectiveness in the reactor 3 which was described above by circulating ultraviolet rays and ozone treated water 5, the reaction time which dioxin decomposition takes must lengthen cycle time, or must make an ozone injection ratio high.
[0005] Moreover, since UV irradiation reinforcement becomes small so that it separates from an ultraviolet ray lamp 2, when arranging the same ultraviolet ray lamp, decomposition effectiveness will become small, so that the path of a reactor 3 is large.
[0006] This invention solves the above-mentioned problem and it aims at offering the sewage disposal approach and equipment which can carry out decomposition removal of the minute amount harmful matter, such as dioxin, efficiently.
[0007]
[Means for Solving the Problem] In order to solve the above-mentioned problem, the sewage disposal approach of this invention according to claim 1 is the sewage disposal approach of processing the sanitary sewage containing minute amount harmful matter, such as dioxin, lets water flow to the ultraviolet-rays reactor holding the photocatalyst which promotes oxidation reaction for said sanitary sewage, and is made to carry out decomposition removal of the minute amount harmful matter in the sanitary sewage by the photocatalyst and ultraviolet rays.
[0008] The sewage disposal approach according to claim 2 introduces ozone inside an ultraviolet-rays reactor, and is made to carry out decomposition removal of the minute amount harmful matter in the sanitary sewage by the photocatalyst, ultraviolet rays, and ozone.
[0009] The photocatalyst of fine particles is used for the sewage disposal approach according to claim 3, and it is made to circulate the sanitary sewage containing the photocatalyst near the outflow section near the inflow section. Moreover, the sewage treatment unit of this invention according to claim 4 is a sewage treatment unit which processes the sanitary sewage containing minute amount harmful matter, such as dioxin, forms an ultraviolet ray lamp in the interior of the reactor of the sealing structure which formed input in the end and formed the tap hole in the other end along a flow direction, and holds the photocatalyst which promotes oxidation reaction.
[0010] A sewage treatment unit according to claim 5 establishes an ozone supply means to supply ozone to the interior of a reactor. The photocatalyst of fine particles is used for a sewage treatment unit according to claim 6, and it establishes a circulation means to circulate through the sanitary sewage which contained the photocatalyst near the tap hole in the reactor near the inflow section, and a photocatalyst separation means to separate a photocatalyst by the near side of a tap hole.
[0011] According to the above-mentioned configuration, by having combined the photocatalyst with the conventional ultraviolet-rays independent processing, or ultraviolet rays and ozone concomitant use mold

processing, the synergistic effect arises, minute amount harmful matter, such as dioxin, can be efficiently disassembled rather than the case where ultraviolet rays, ozone, and a photocatalyst are used independently, cracking severity higher than before and the short processing time can be realized, and reduction of an ozone injection ratio is also possible.

[0012] Minute amount harmful matter, such as dioxin, means soluble organic nature pollutants, such as chlorinated organic compounds, such as dioxin, trihalomethane, and a trichloroethylene. A titanium dioxide, vanadium pentoxide, etc. can be used as a photocatalyst.

[0013] The decomposition mechanism of the minute amount harmful matter at the time of combining a photocatalyst is considered to be the following.

1) By ultraviolet rays, a free electron and a free electron hole (after an electron falls out) are generated in the photocatalyst itself, and the produced electron hole reacts to it with direct harmful matter, and understand harmful matter an oxidized part, or an electron hole reacts with water, and generate OH radical and generated OH radical carries out oxidative degradation of the harmful matter.

[0014] 2) A photocatalyst disassembles the intermediate product produced from harmful matter by ozonization even for the harmless matter. Since it circulates through what was followed on the flow of the sanitary sewage and moved near the outflow section near the inflow section while surface area becomes large when photocatalysts are fine particles, a photocatalyst will be held almost equally in a reactor, ratio contact with minute amount harmful matter becomes large, and the decomposition effectiveness of minute amount harmful matter becomes high.

[0015]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained, referring to a drawing. In case sanitary sewage containing harmful matter, such as dioxin, such as a leachate of the trash final disposal site which reclaimed land from domestic wastes or industrial waste, is processed, first, the same with having explained previously, impurity, sand, etc. in the sanitary sewage are removed, coagulation sedimentation of the heavy metal, such as calcium and manganese, is carried out, decomposition removal of the BOD matter or the nitrogen content is carried out by biological treatment, and coagulation sedimentation of the difficulty resolvability COD matter, the suspended solid, etc. is carried out. And after carrying out sand filtration of this sand filtration treated water and removing a detailed suspended solid, water is returned to ultraviolet rays and an ozone reactor.

[0016] As shown in drawing 1 , ultraviolet rays and an ozone reactor are equipped with the tubed direct-vent-system reactor 11 of the vertical direction, the ultraviolet ray lamp 12 ranging from the upper limit to a lower limit is formed in an axial center location, and the powder titanium dioxide which is a photocatalyst 13 is thrown into the interior of this reactor 11. The supply pipe 15 which infixed the feed pump 14 connected, and while the network 16 which separates a photocatalyst 13 is formed in the tap hole formed in the upper part, the end of the excurrent canal 18 which results in pH control equipment 17 has connected with the input formed in the lower part of a reactor 11. While the return tubing 19 led from pH control equipment 17 and the ozone supply pipe 21 led from the ozonator 20 connect with the lower part, the circulation tubing 22 which was open for free passage near the tap hole near the input is formed in the reactor 11 again. 23 — a column — inner ** ozone — a ** ozonolysis — the ** ozone delivery tube derived to a column (not shown), the treated water exhaust pipe with which 24 infixed the eductor pump 25, dosing tubing with which 26 pours in pH regulators, such as a sulfuric acid and caustic alkali of sodium, and 27 and 28 are circulating pumps.

[0017] In such ultraviolet rays and an ozone reactor, the sand filtration treated water W1 to which water was returned as it mentioned above flows into the interior of a reactor 11 with a supply pipe 15, and flows upward with a photocatalyst 13, and ultraviolet rays are irradiated from an ultraviolet ray lamp 12 in this condition, and ozone is supplied through the ozone supply pipe 21 from an ozonator 20. The ultraviolet rays irradiated from an ultraviolet ray lamp 43 are both fields (180**50nm and 250**50nm) or a 300**50nm field, and ozone is 80**10gO3 / m3. It is supplied so that it may become.

[0018] the sand filtration treated water W1 near the tap hole penetrates a network 16, and draws it to pH control equipment 17 with an excurrent canal 18 as ultraviolet rays and ozone treated water W2 — having — a network 16 — a column — it circulates through the photocatalyst 13 which remained inside near the input through the circulation tubing 22 with surrounding sand filtration treated water W1. some of ultraviolet rays and ozone treated water W2 drawn to pH control equipment 17 — the return tubing 19 — leading — a column — circulation return is carried out inside and, thereby, suitable reaction time is secured.

[0019] during this period — sand filtration treated water W1 — the ultraviolet rays of the above-mentioned suitable wavelength, the ozone of suitable concentration, and a column — the powder photocatalyst 13 held almost equally inside will be contacted enough, and decomposition removal of minute amount harmful matter, i.e., the soluble organic nature pollutants, such as dioxin in sand filtration treated water W1, is efficiently carried out by the synergistic effect of ultraviolet rays, ozone, and a photocatalyst 13.

[0020] Remaining ultraviolet rays and ozone treated water W2 in pH control equipment 17 are drawn out out of a system through the treated water exhaust pipe 24, after being neutralized by pH regulator from the dosing tubing 26. The decomposition elimination factor of the dioxin in the conventional ultraviolet-rays independent processing and ultraviolet rays and ozone concomitant use processing, and the above-mentioned ultraviolet rays, above-mentioned ozone, and photocatalyst concomitant use processing is shown in following Table 1. As shown in Table 1, in ultraviolet rays, ozone, and photocatalyst concomitant use processing, after 30 minutes, decomposition removal of about 100% of dioxin is carried out, and high cracking severity and short reaction time are realized compared with the conventional processing. If reaction time comparable as the former is secured, reduction of an

ozone injection ratio is also possible.
[0021]
[Table 1]

		紫外線のみ	紫外線+オゾン	紫外線+オゾン+光触媒
反応時間	３０分	９０％以上	９５％以上	ほぼ１００％
	３００分	９５％以上	９８％以上	ほぼ１００％

[0022] It was able to carry out in reaction-time 30 minutes, and even if processed with ultraviolet rays and a photocatalyst, without having replaced with the above-mentioned approach and pouring in ozone, the decomposition effectiveness of minute amount harmful matter, such as dioxin, could be raised, and 98% or more of dioxin was able to carry out decomposition removal in 300 minutes 95% or more in this case.
[0023]
[Effect of the Invention] As mentioned above, according to this invention, by combining a photocatalyst with the conventional ultraviolet-rays independent processing, or ultraviolet rays and ozone concomitant use mold processing, minute amount harmful matter, such as dioxin, can be efficiently disassembled by these synergistic effects, and cracking severity higher than before and short reaction time can be realized. And as a result of being able to shorten reaction time, compaction of the residence time, as a result miniaturization of equipment can be attained. Moreover, since comparatively low-concentration ozone can also disassemble harmful matter, cost reduction can be planned and the risk of ozone leakage can also be reduced.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view having shown the ultraviolet rays and the whole ozone reactor configuration in 1 operation gestalt of this invention used for processing of the sanitary sewage containing harmful matter, such as dioxin.
[Drawing 2] It is the explanatory view having shown conventional ultraviolet rays and whole ozone reactor configuration.
[Description of Notations]
W1 Sand filtration treated water (sanitary sewage)
W2 Ultraviolet rays and ozone treated water
11 Reactor
12 Ultraviolet Ray Lamp
13 Photocatalyst
15 Supply Pipe (Input)
16 Network
18 Excurrent Canal (Tap Hole)
20 Ozonator
22 Circulation Tubing

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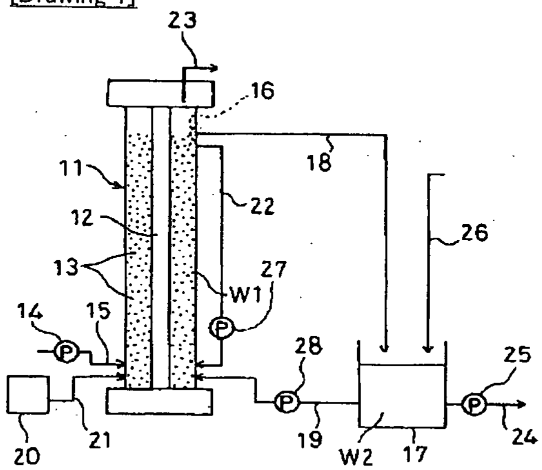
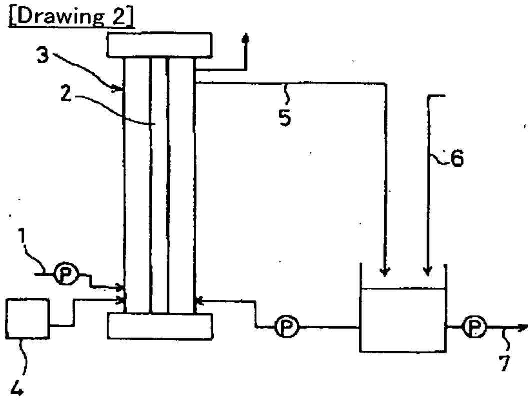
DRAWINGS

[Drawing 1]



W1	砂濾過処理水（汚水）
W2	紫外線・オゾン処理水
11	反応塔
12	紫外線ランプ
13	光触媒
15	供給管（流入口）
16	ネット
18	流出管（流出口）
20	オゾン発生器
22	循環管

[Drawing 2]



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	1/58			1/58	Ａ
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審査請求　未請求　請求項の数６　ＯＬ　（全　４　頁）

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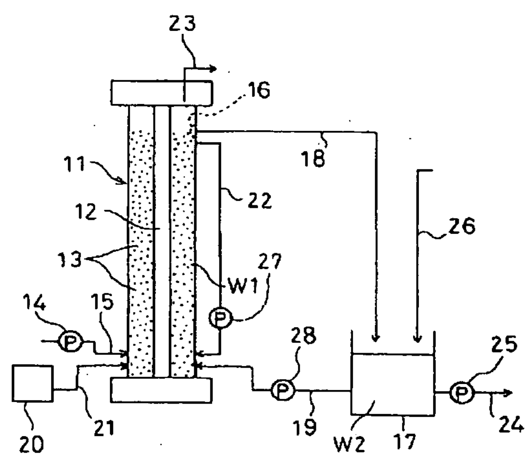
(54)【発明の名称】　汚水処理方法および処理装置

(57)【要約】
【課題】　ダイオキシン類等の微量有害物質を効率よく分解除去できる汚水処理方法および処理装置を提供する。
【解決手段】　ダイオキシン類等の微量有害物質を含んだ砂濾過処理水Ｗ１を、酸化反応を促進する光触媒１３を保持した反応塔１１へ通水し、光触媒１３と紫外線ランプ１２からの紫外線とにより前記微量有害物質を分解除去する。



W1　砂濾過処理水（汚水）
W2　紫外線・オゾン処理水
11　反応塔
12　紫外線ランプ
13　光触媒
15　供給管（流入口）
16　ネット
18　流出管（流出口）
20　オゾン発生器
22　循環管

【特許請求の範囲】

【請求項１】　ダイオキシン類等の微量有害物質を含んだ汚水を処理する汚水処理方法であって、前記汚水を、酸化反応を促進する光触媒を保持した紫外線反応塔へ通水し、光触媒と紫外線とにより汚水中の微量有害物質を分解除去することを特徴とする汚水処理方法。

【請求項２】　紫外線反応塔の内部へオゾンを導入し、光触媒と紫外線とオゾンとにより汚水中の微量有害物質を分解除去することを特徴とする請求項１記載の汚水処理方法。

【請求項３】　光触媒が粉体であり、流出部近傍の光触媒を含んだ汚水を流入部近傍へ循環させることを特徴とする請求項１または請求項２のいずれかに記載の汚水処理方法。

【請求項４】　ダイオキシン類等の微量有害物質を含んだ汚水を処理する汚水処理装置であって、一端に流入口を形成し、他端に流出口を形成した密閉構造の反応塔の内部に、流れ方向に沿って紫外線ランプを設け、酸化反応を促進する光触媒を保持したことを特徴とする汚水処理装置。

【請求項５】　反応塔の内部にオゾンを供給するオゾン供給手段を設けたことを特徴とする請求項４記載の汚水処理装置。

【請求項６】　光触媒が粉体であり、反応塔に、流出口近傍の光触媒を含んだ汚水を流入部近傍に循環する循環手段と、流出口の手前側で光触媒を分離する光触媒分離手段とを設けたことを特徴とする請求項４または請求項５のいずれかに記載の汚水処理装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、廃棄物最終処分場の浸出水など、ダイオキシン類等の微量有害物質を含んだ汚水を処理する汚水処理方法および処理装置に関する。

【０００２】

【従来の技術】たとえば、一般廃棄物や産業廃棄物を埋立てた廃棄物最終処分場の浸出水を処理する際には、浸出水中の夾雑物や砂等を除去し、カルシウムやマンガンなどの重金属を凝集沈殿させ、ＢＯＤ物質や窒素分を生物処理により分解除去し、難分解性ＣＯＤ物質や浮遊物質などを凝集沈殿させ、さらに微細な浮遊物質を砂濾過により除去している。

【０００３】そして、図２に示したように、浮遊物質を含まない砂濾過処理水１を、紫外線ランプ２を設置した反応塔３に通水し、紫外線ランプ２より照射される紫外線とオゾン発生器４より供給されるオゾンとに接触させることにより、砂濾過処理水１中に残存するダイオキシン類等の微量有害物質を分解除去し、反応塔３より流出する紫外線・オゾン処理水５を硫酸や苛性ソーダなどのｐＨ調整剤６で中和して処理水７としている。

【０００４】

【発明が解決しようとする課題】ところで、ダイオキシン類分解に要する反応時間は比較的長いので、上記したような反応塔３では通常、紫外線・オゾン処理水５を循環させることによって反応時間を確保しており、分解効率を上げるためには、循環時間を長くするか、あるいはオゾン注入率を高くしなければならない。

【０００５】また、紫外線ランプ２から離れるほど紫外線照射強度が小さくなるので、同様の紫外線ランプを配置する場合は、反応塔３の径が大きいほど分解効率が小さくなってしまう。

【０００６】本発明は上記問題を解決するもので、ダイオキシン類等の微量有害物質を効率よく分解除去できる汚水処理方法および装置を提供することを目的とするものである。

【０００７】

【課題を解決するための手段】上記問題を解決するために、本発明の請求項１記載の汚水処理方法は、ダイオキシン類等の微量有害物質を含んだ汚水を処理する汚水処理方法であって、前記汚水を、酸化反応を促進する光触媒を保持した紫外線反応塔へ通水し、光触媒と紫外線とにより汚水中の微量有害物質を分解除去するようにしたものである。

【０００８】請求項２記載の汚水処理方法は、紫外線反応塔の内部へオゾンを導入し、光触媒と紫外線とオゾンとにより汚水中の微量有害物質を分解除去するようにしたものである。

【０００９】請求項３記載の汚水処理方法は、粉体の光触媒を使用し、流出部近傍の光触媒を含んだ汚水を流入部近傍へ循環させるようにしたものである。また本発明の請求項４記載の汚水処理装置は、ダイオキシン類等の微量有害物質を含んだ汚水を処理する汚水処理装置であって、一端に流入口を形成し、他端に流出口を形成した密閉構造の反応塔の内部に、流れ方向に沿って紫外線ランプを設け、酸化反応を促進する光触媒を保持したものである。

【００１０】請求項５記載の汚水処理装置は、反応塔の内部にオゾンを供給するオゾン供給手段を設けたものである。請求項６記載の汚水処理装置は、粉体の光触媒を使用し、反応塔に、流出口近傍の光触媒を含んだ汚水を流入部近傍に循環する循環手段と、流出口の手前側で光触媒を分離する光触媒分離手段とを設けたものである。

【００１１】上記した構成によれば、従来の紫外線単独処理または紫外線・オゾン併用型処理に光触媒を組み合わせたことによって相乗効果が生じ、紫外線やオゾンや光触媒を単独で用いる場合よりもダイオキシン類等の微量有害物質を効率よく分解することができ、従来より高い分解率および短い処理時間を実現でき、オゾン注入率の低減も可能である。

【００１２】ダイオキシン類等の微量有害物質とは、ダ

イオキシン類、トリハロメタン、トリクロロエチレン等の有機塩素系化合物などの溶解性有機性汚濁物質をいう。光触媒としては、二酸化チタン、五酸化バナジウムなどを使用できる。

【００１３】光触媒を組み合わせた際の微量有害物質の分解メカニズムは次のようなものと考えられる。

１）紫外線によって光触媒自体に自由な電子と正孔（電子が抜けたあと）が生じ、生じた正孔が直接有害物質と反応して有害物質を酸化分解するか、あるいは正孔が水と反応してＯＨラジカルを生成し、生成したＯＨラジカルが有害物質を酸化分解する。

【００１４】２）オゾン処理によって有害物質より生じた中間生成物を、光触媒が無害物質まで分解する。光触媒が粉体である場合、表面積が大きくなるとともに、汚水の流れに伴われて流出部近傍へ移動したものは流入部近傍へ循環されるので、反応塔内にほぼ均等に光触媒が保持されることになり、微量有害物質との接触率が大きくなり、微量有害物質の分解効率が高くなる。

【００１５】

【発明の実施の形態】以下、本発明の一実施形態を図面を参照しながら説明する。一般廃棄物や産業廃棄物を埋立てた廃棄物最終処分場の浸出水など、ダイオキシン類等の有害物質を含んだ汚水を処理する際にはまず、先に説明したのと同様にして、汚水中の夾雑物や砂等を除去し、カルシウムやマンガンなどの重金属を凝集沈殿させ、ＢＯＤ物質や窒素分を生物処理により分解除去し、難分解性ＣＯＤ物質や浮遊物質などを凝集沈殿させる。そして、この砂濾過処理水を砂濾過して微細な浮遊物質を除去した後に、紫外線・オゾン反応装置に送水する。

【００１６】図１に示したように、紫外線・オゾン反応装置は、上下方向の筒状密閉式反応塔１１を備えており、この反応塔１１の内部に、上端から下端にわたる紫外線ランプ１２が軸心位置に設けられ、光触媒１３である粉状二酸化チタンが投入されている。反応塔１１の下部に形成した流入口には、供給ポンプ１４を介装した供給管１５が接続し、上部に形成した流出口には、光触媒１３を分離するネット１６が設けられるとともに、ｐＨ調整槽１７に至る流出管１８の一端が接続している。反応塔１１にはまた、ｐＨ調整槽１７より導かれた返送管１９と、オゾン発生器２０から導かれたオゾン供給管２１とが下部に接続するとともに、流入口近傍と流出口近傍とに連通した循環管２２が設けられている。２３は塔＊＊内の排オゾンを排オゾン分解塔（図示せず）へ導出する排オゾン導出管、２４は排出ポンプ２５を介装した処理水排出管、２６は硫酸や苛性ソーダなどのｐＨ調整剤を注入する薬注管、２７，２８は循環ポンプである。

【００１７】このような紫外線・オゾン反応装置では、上述したようにして送水された砂濾過処理水Ｗ１が供給管１５により反応塔１１の内部に流入し、光触媒１３とともに上向きに流れ、この状態において、紫外線ランプ１２より紫外線が照射され、かつオゾン発生器２０よりオゾン供給管２１を通じてオゾンが供給される。紫外線ランプ４３より照射される紫外線は、１８０±５０ｎｍと２５０±５０ｎｍの両領域、あるいは３００±５０ｎｍの領域であり、オゾンは８０±１０gO_3/m^3 となるように供給される。

【００１８】流出口近傍の砂濾過処理水Ｗ１は、ネット１６を透過して紫外線・オゾン処理水Ｗ２として流出管１８によりｐＨ調整槽１７へ導出され、ネット１６により塔内に残留した光触媒１３は周囲の砂濾過処理水Ｗ１とともに循環管２２を通じて流入口近傍へ循環される。ｐＨ調整槽１７へ導出された紫外線・オゾン処理水Ｗ２の一部も返送管１９を通じて塔内へ循環返送され、これにより適当な反応時間が確保される。

【００１９】この間に、砂濾過処理水Ｗ１は、上記適当波長の紫外線と適当濃度のオゾンと塔内にほぼ均等に保持された粉状光触媒１３とに十分接触することになり、砂濾過処理水Ｗ１中のダイオキシン類等の微量有害物質、すなわち溶解性有機性汚濁物質は、紫外線とオゾンと光触媒１３の相乗効果で効率よく分解除去される。

【００２０】ｐＨ調整槽１７内の残りの紫外線・オゾン処理水Ｗ２は、薬注管２６からのｐＨ調整剤により中和された後、処理水排出管２４を通じて系外へ引き抜かれる。以下の表１に、従来の紫外線単独処理および紫外線・オゾン併用処理と、上記した紫外線・オゾン・光触媒併用処理とにおけるダイオキシン類の分解除去率を示す。表１からわかるように、紫外線・オゾン・光触媒併用処理では、３０分後にはダイオキシン類のほぼ１００％が分解除去されており、従来の処理に比べて高い分解率および短い反応時間が実現されている。従来と同程度の反応時間を確保すれば、オゾン注入率の低減も可能である。

【００２１】

【表１】

		紫外線のみ	紫外線+オゾン	紫外線+オゾン+光触媒
反応時間	３０分	９０％以上	９５％以上	ほぼ１００％
	３００分	９５％以上	９８％以上	ほぼ１００％

【００２２】上記方法に代えて、オゾンを注入することなく紫外線と光触媒とで処理しても、ダイオキシン類等の微量有害物質の分解効率を高めることができ、この場合、反応時間３０分で９５％以上、３００分で９８％以

上のダイオキシン類を分解除去できた。

【００２３】

【発明の効果】以上のように本発明によれば、従来の紫外線単独処理または紫外線・オゾン併用型処理に光触媒を組み合わせることによって、これらの相乗効果でダイオキシン類等の微量有害物質を効率よく分解することができ、従来より高い分解率および短い反応時間を実現できる。そして、反応時間を短縮できる結果、滞留時間の短縮、ひいては装置のコンパクト化を図ることができる。また、比較的低濃度のオゾンでも有害物質を分解できるので、コスト低減を図ることができ、オゾン漏洩のリスクも低減できる。

【図面の簡単な説明】

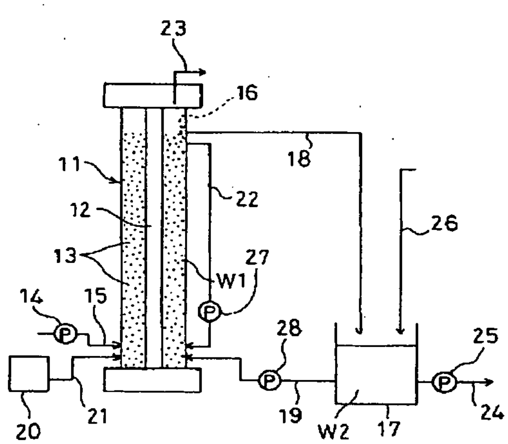
【図１】ダイオキシン類等の有害物質を含んだ汚水の処理に使用される本発明の一実施形態における紫外線・オゾン反応塔の全体構成を示した説明図である。

【図２】従来の紫外線・オゾン反応塔の全体構成を示した説明図である。

【符号の説明】

W1　砂濾過処理水（汚水）
W2　紫外線・オゾン処理水
11　反応塔
12　紫外線ランプ
13　光触媒
15　供給管（流入口）
16　ネット
18　流出管（流出口）
20　オゾン発生器
22　循環管

【図１】



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【図２】